

# CS 621 Assignment 3

## Deadline December 3th (11:00 am)

**Problem 0.1** *Let  $T$  be a tree with  $n$  vertices. What are the smallest and largest numbers of cut points that  $T$  can have? How many bi-connected components does  $T$  have in each of these case?*

**Problem 0.2** *We are given a digraph  $D$  with adjacency matrix  $A$ . We compute  $A^3$  and sum the diagonal values. What this value counts ?*

**Problem 0.3** *We are given a  $k$ -regular bipartite graph  $H$  (every vertex has degree  $k$ ). Show that we can color the edges of  $H$  with  $k$ -colors such that the edges incident to a same vertex receive different colors.*

**Problem 0.4** *We are given a bipartite graph  $H = (C, R, E)$ . We want to find an assignment of the resources to the customers such that each customer receives at least  $b$  resources from  $R$ . What is the necessary condition ? If the necessary condition is satisfied then how we can find such an assignment.*

**Problem 0.5** *We are given a graph  $G$  where the length of the longest path in  $G$  is 2014. Is there a way of (proper) coloring the vertices in  $G$  with 2015 colors? In the proper coloring adjacent vertices must receive different colors.*